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Def Doc 500-A-2

JAPANESE TRADE STUDIES

Special Industry Analysis  
No. 2

ALUMINUM

Prepared for the  
Foreign Economic Administration  
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January 1945

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# FOREWORD

This is one of a series of Special Industry Analyses discussing from a commodity or individual industry viewpoint the outstanding items entering into the trade of Japan proper with its Empire and with foreign countries. These analyses are a part of a larger project which includes compilations (annotated) of the imports and exports of Japan proper by sources and destinations; surveys of certain of the colonial areas, emphasizing their Empire and foreign trade and post-war problems relating thereto; an over-all study of the trade of Japan proper; and a survey of Japan's shipbuilding industry and shipping services and requirements in the pre-war period. In all of the studies Manchuria has been included as an Empire area owing to the political, economic, and military dominance of Japan in that area, especially during the last decade.

Most of the data in these analyses were taken from official and semi-official Japanese sources. Not only have errors and inconsistencies frequently been detected within individual volumes, but many data from different sources supposedly reporting on the same subject are irreconcilable. It is very likely that large shipments of goods reportedly moving to Kwantung from Japan have been in large part merely transshipments destined for Manchuria. In addition, the data probably exclude large shipments of commodities made to and from Empire areas for military purposes.

The present report is one of a number which were prepared during 1944 and 1945 for the Foreign Economic Administration by members of the staff of the United States Tariff Commission. Owing to the desire of the Foreign Economic Administration to obtain this material as promptly as possible, the reports were not reviewed by the Tariff Commission. All statements of fact or opinion in these reports are attributable to the individual staff members who prepared them. The reports were originally intended for confidential use of government agencies, but are now being made public with the consent of the Foreign Economic Administration.

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## ALUMINUM

### Introduction and summary.

Aluminum was of great importance to the peacetime metal manufacturing industries of Japan. Production of aluminum in Japan itself did not begin, however, until 1934, and, although the Japanese output increased during 1935-38, it represented only about 2.5 percent of the world total. Almost no bauxite, the chief raw material, is available in Japan proper, however, and before World War II interrupted world trade, Japan imported about half of the aluminum it consumed. Its consumption of aluminum, therefore, amounted to about 5 percent of the world total. In 1940 production in Japan proper approximated 35,000 tons. Since 1940 the capacity of the industry in Japan has increased to several times its former size, however, and the output is much greater than would be justified in peacetime.

During the war Japan has built more aluminum plants than any other country in the world, but most of them have a much smaller capacity than the plants in the United States and Canada. It has been estimated that primary production of aluminum in the Japanese Empire has reached a wartime peak of about 120,000 tons (as compared to about a million tons for the United States).

The growth of the industry has taken place in a period of preparation for war as well as in a period of natural industrial expansion; for this reason the available statistics do not furnish a very reliable index of Japan's peacetime requirements.

If Japan is allowed to produce metals generally on a moderate basis after the war, however, her peacetime requirements of aluminum will, it is believed, approximate 15,000 to 25,000 tons, depending on the general level of metal production determined upon and depending on whether or not the aircraft industry, a heavy consumer of aluminum, is completely eliminated in Japan or continues on a modest level of production.

One of several policies might be adopted in connection with Japan's aluminum industry in the post-war period. If it were decided to control Japan's ability to make war in part through severely restricting or eliminating a certain few key war industries, the production of aluminum in Japan might be prohibited, as it has several uses of great importance to the prosecution of war. If the domestic production of aluminum were prohibited, and yet certain other metal manufacturing industries were allowed to continue operation at a specified level, aluminum would be in demand for alloying and compounding with other metals in making various civilian products. These needs could be filled by importation of aluminum.

Another possible policy which might be applied in the case of the aluminum industry in Japan would be to force the elimination of all production or export subsidies, or any other type of assistance to the industry

from outside interests. Under such a policy the quantity of aluminum produced in Japan would "seek its own level," depending in the long run on the relation between costs of production and prices in Japan and in other nations.

It is believed that the aluminum industry in Japan proper would be economical only when its output approximated levels of production of 15,000 to 20,000 tons, so that if it were forced to compete with foreign producers of aluminum in world markets, the amount which it could produce domestically would be severely reduced below present levels. The cost of electric power would no longer be excessive, as sufficient power in excess of the demand for other uses would be available for aluminum manufacture. At any considerably higher level of production the drain on power supplies in Japan in the past has been such that costs have increased steadily.

In regard to raw materials only modest amounts of bauxite would be required to be imported to attain the smaller levels of output mentioned above; this would reduce requirements of Japan for shipping space required to carry a bulky product like bauxite from the source of supply to Japan proper. In order to produce 20,000 tons of aluminum ingots, Japan would need to import about 100,000 tons of bauxite. <sup>1/</sup>

Japan's raw material position will not be greatly altered by the loss of the mandated islands, as the bauxite reserves there are not considered very large. The loss of control over fluorspar deposits in Manchuria and Korea would not be a serious handicap to the aluminum industry in Japan, as the quantities used are small and might be imported from these or other sources.

From the standpoint of the control of Japan's military potential, the existence of many small aluminum plants in Japan proper would be undesirable. Small plants are capable of rapid expansion as long as power can be diverted from other uses.

In regard to reparations, the tremendous excess stock of aluminum in Allied countries combined with the uneconomical nature of a large-scale Japanese aluminum industry make it appear inadvisable for Japan to operate her aluminum plants to furnish supplies of aluminum products to China, Southeast Asia, or India after the war. On the other hand, if the operating plants in Manchuria and Korea are not destroyed, one of these might eventually produce aluminum for use in Manchuria or northern China.

#### Importance and uses of aluminum in Japan.

In pre-war years aluminum became a vital part of the Japanese industry of Japan. Not only was it needed for the military and naval program, but it was substituted for many metals which Japan would otherwise

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<sup>1/</sup> Additional bauxite required for abrasives and chemicals might raise the total of bauxite imports by 70,000 tons.



have had to import in order to supply even civilian requirements. Table 1 illustrates the pattern of aluminum consumption by industry.

Table 1.- Aluminum: Consumption in Japan proper, by specified industries, 1934

Industry	Quantity	Percent of total
Transportation (land, water, and air) <sup>1/</sup>	4,280	38
Household utensils and food equipment	1,802	16
Electric cables and wire	1,915	17
Machinery	901	8
Steel metallurgy	901	8
Nonferrous alloys	450	4
Building	338	3
Chemical equipment	225	2
Other	450	4
Total	11,262	100

<sup>1/</sup> The aircraft capacity in 1934 was only 800 military planes annually. The aircraft industry, therefore, consumed very little metal at that time.

Sources: Percentages--The Mining Magazine (London), vol. 59, No. 2, August 1938, p. 81. Quantity--See table 2.

During the peak of wartime activity this pattern of aluminum consumption would naturally change; a greater proportion would be consumed in the transportation industry, 65 percent or more probably going into the production of aircraft alone. The percentage going into machinery, steel metallurgy, and nonferrous alloys would also increase.

In many uses aluminum alloys can be substituted for certain alloy steels. As indicated in table 1, aluminum can also be substituted for copper in cables and wire. Aluminum foil can replace lead and tin in many uses.

The number of men employed in the production of aluminum metal is relatively very small; employment in metal fabrication is far more important.

Summary of production, imports, exports,  
and apparent consumption.

Table 2.- Aluminum: Summary of production, imports, exports, and  
apparent consumption in Japan proper and Karafuto,  
1928-40

(In metric tons)						
Year	Pro- duction	Imports <sup>1/2/</sup>	Exports <sup>1/</sup> To Empire areas <sup>3/</sup>	Other	Apparent con- sumption <sup>1/</sup>	
1928	-	9,340	-	17	9,323	
1929	-	12,253	-	411	11,842	
1930	-	11,601	-	696	10,905	
1931	-	5,203	-	211	4,992	
1932	-	8,641	2	336	8,303	
Average, 1928-32	-	9,408	-	334	9,074	
1933	-	8,278	2	238	8,038	
1934	664	10,946	2	346	11,262	
1935	4,400	14,079	7	1,011	17,461	
1936	7,000	10,706	12	860	16,834	
1937	10,500	12,055	201	610	21,744	
Average, 1933-37	4,513	11,213	45	613	15,068	
1938	17,100	27,370	387	530	4/ 38,500	
1939	23,000	28,070	5/	5/	4/ 40,000	
1940	6/ 35,000	508	5/	5/	5/	

<sup>1/</sup> Includes scrap, crude metal, and shapes, but not manufactures.

<sup>2/</sup> Imports from other than Empire areas. Compiled from official data of exporting countries, data do not agree perfectly with those shown in table 5. Data for Manchuria, Formosa, Korea, and mandated islands are not available, but some imports may have been made from Manchuria after 1938.

<sup>3/</sup> Includes Manchuria, Formosa, Korea, and mandated islands.

<sup>4/</sup> Estimated consumption; apparent consumption in 1938 was 43,553 tons.

<sup>5/</sup> Not available.

<sup>6/</sup> Estimated.

Source: Compiled from various sources.

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For a number of years (1917-34) Japan was engaged in the fabrication of aluminum from imported crude metal and scrap, while domestic consuming industries continued to increase their demands for the metal. The many early attempts to establish primary aluminum ingot smelters were unsuccessful, owing chiefly to lack of bauxite and shortages of power. Under

increasing pressure from military authorities, however, smelting facilities were established --in spite of the handicaps encountered in the earlier attempts. The Government first encouraged the construction of hydroelectric plants. By 1932 some excess power was available for aluminum production; the first successful plant came into operation in 1934.

Direct Government control of the industry was first established by the Light Metals Manufacturing Law, which licensed all Japanese aluminum companies. Those licensed were exempted from certain custom duties and certain taxes. Direct subsidies were given to certain manufacturers of aluminum products.

#### Distribution of productive facilities.

Development of hydroelectric power was the prime factor in the expansion and location of the Japanese aluminum industry. From 9 to 10 percent of all electric power is consumed in the production of aluminum. About 12 aluminum producing plants are reported in Japan proper and about 8 in other Empire areas; the average output of each of these plants is smaller by far than that of plants in the United States or Canada. Relatively wide distribution of the industry in small plants allows it to take advantage of the limited excess power in each area. Such distribution has also strategic significance from the standpoint of national defense. The industry is completely integrated with larger industrial and chemical interests.

Little detailed information is available as to the development of aluminum plants in Formosa, Korea, and Manchuria or their relation to aluminum supply and demand in Japan proper. Aluminum-producing companies known to exist in the early part of 1938 included one in Formosa and one in Manchuria (see table 3).

The Five-Year Plan as announced by the Japanese Department of Commerce and Industry in 1937 intended to increase aluminum plant capacity to about 175,000 tons. Except when operating at peak capacity under great pressure, the actual output of these plants probably would have been less than this stated capacity, or about 75,000 tons of ingot in Japan proper (including Formosa and Korea at that time) and about 45,000 tons in Manchuria. A national cartel of all Japanese producers was to be organized under state direction in order to promote this plan. Several plants were projected and several new companies announced their intention of engaging in aluminum production. Exact knowledge of the success of these ventures must await an actual inspection at the close of the war.



Table 3.- Japanese Empire: Location and capacity of aluminum plants, early in 1938

(In metric tons)				
Country	Location	Capacity at the end of 1937	After additions, 1938-41	Remarks
Japan Electro-Chemical Co. Ltd. (1934) <sup>1/</sup>	Omachi	6,000	15,000	Alumina and cryolite plant at Yokohama. Used Malayan bauxite, also some alunite from Chosen.
Japan-Manchuria Aluminum Co. Ltd. (1935)	Higashi-Iwase	7,000	12,000	Used thermic process with shale and bauxite.
Sumitomo Aluminum Reduction Co., Ltd. (1936) <sup>2/</sup>	Niihama	2,500	10,000	Used some alunite. Power part steam and part hydroelectric. Bauxite from Palau.
Japan Soda Co., Ltd. (1937) <sup>3/</sup>	Takaoka	3,000	8,000	Bauxite from British India.
Japan Aluminum Co., Ltd. (1936) <sup>4/</sup>	Formosa	6,000	12,000	Bauxite from the Netherlands Indies.
Manchuria Light Metal Mfg. Co., Ltd. (1938) <sup>5/</sup>	Manchuria	4,000	20,000	Used shale.
		28,500	77,000	

<sup>1/</sup> Composed of Showa Fertilizer Co., Ltd., Poshin Electric Co., Ltd., and the Japan Iodine Co., Ltd.

<sup>2/</sup> Owned by the Sumitomo Goshi Kaisha, holding company for all the Sumitomo enterprises. Consumes its own ingot in subsidiary manufacturing plants.

<sup>3/</sup> This company is also one of the largest heavy chemical producers in Japan.

<sup>4/</sup> Participants in this enterprise are Mitsui, Mitsubishi, Sumitomo, and Furukawa interests and the Taiwan Electric Power Co. It is associated with the aluminum cartel.

<sup>5/</sup> Participants in this company are the South Manchuria Railway Co. and the Government of Manchukuo, Sumitomo, Japan Soda Co., Ltd., and the Japan-Manchuria Aluminum Co., Ltd.

Source: The Mining Magazine, vol. 59, No. 2, August 1938, London.

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Table 4.- Bauxite: Imports into Japan proper, by sources, <sup>1/</sup> 1935-39

(In metric tons)						
Country	1935	1936	1937	1938	1939	
Netherlands Indies ---	<sup>2/</sup>	<sup>2/</sup>	<sup>2/</sup>	<sup>2/</sup>		168,428
British Malaya <sup>3/</sup> ----	355	1,123	13,241	56,643		85,737
Greece -----	5,250	8,000	7,300	15,000		23,959
British India <sup>4/</sup> ----	4,481	5,327	23,748	<sup>2/</sup>	<sup>2/</sup>	
Total (incomplete)-:	10,086	14,450	44,289	71,643		278,124

<sup>1/</sup> From statistics of supplying countries.<sup>2/</sup> Not available.<sup>3/</sup> Classified as "Other nonferrous ores" thought to be chiefly bauxite.<sup>4/</sup> Classified as "Ores unenumerated," year ending March 31, the following year.

The exact extent to which the Japanese industry depends on substitutes for bauxite at present is not known, but it is known that after 1939 the Government offered subsidies to companies using domestic raw materials. On the other hand, under the Light Metals Manufacturing Law, licensed companies were exempted from duties on imported materials for their plants.

Fluorspar for the Japanese aluminum industry as well as the iron and steel industry has been obtained from Kokui-do (Hwanghae-do) district and elsewhere in Korea and in the Mukden area in Manchuria. These sources produced approximately 10,000 tons annually during the period 1934-36.

#### Production.

Marked expansion in the production of aluminum in Japan was achieved in a brief period of 7 years. Starting at 664 metric tons by one company in 1934, output increased to 10,500 tons by 5 companies in 1937. The level of output attained during 1936 and 1937 appears to coincide more nearly with the nation's normal requirements than that of earlier (or later) years. Thereafter capacity grew rapidly as additional power

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Until 1937 from one- to two-fifths of the coal exports went to Empire areas, but after 1933 about two-thirds went to these areas. The principal foreign markets for Japanese coal were China, Hong Kong, the Straits Settlements, and the Philippine Islands.

Korea was the one substantial market within the Empire for the bituminous coal of Japan proper. In 1940, exports of coal from Japan to Korea reached 1,441,000 tons, compared with 332,000 tons in 1928. Other Empire areas--Manchuria, Formosa, and Karafuto--have not been dependent upon Japan for very considerable quantities of bituminous coal as they have excess supplies of this and other types for export.

To a large extent the export trade is related to back hauls resulting from excess shipping space; to the necessity, and relative ease of supplying coastal industries in other areas from Japan, such as food-processing plants; and to a freight rate structure favorable to shipping coal by water. The increase in exports to Korea, even though Korea has an excess of coal, was due largely to the extensive expansion in manufacturing plants in Korea; some of these plants are adjacent to deep-water harbors, which afford easy access to coal imported from overseas.

As to coke, Japan has been on an export basis. Exports of coke showed a considerable increase well before 1941. Korea and Formosa have been the only areas to which coke has been exported, and Korea has been by far the larger market; exports to Korea increased from an average of 34,500 tons in 1933-37 to 161,000 tons in 1940 (see table 8).

Table 8.- Coke: Exports from Japan by markets, averages, 1923-32, 1933-37, annual 1938-40 <sup>1/</sup>

(In thousands of metric tons)				
Year	:	Formosa	:	Korea
Average, 1928-32 -----	:	6.2	:	5.3
Average, 1933-37 -----	:	2.1	:	34.7
1938 -----	:	4.9	:	53.1
1939 -----	:	<u>2/</u>	:	135.8
1940 -----	:	<u>2/</u>	:	161.0

<sup>1/</sup> As indicated by imports of Korea and Formosa.  
<sup>2/</sup> Not available.

Source: Annual Returns of the Trade of Taiwan (Formosa), Tables of the Trade and Shipping of Chosen (Korea).

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The exports of coke to Korea were valued at less than 1 million yen annually before 1937, but by 1940 the value had risen to almost 10 million yen. In 1938 exports to Formosa were valued at only 375,000 yen. The rapid increase in exports to Korea is attributable mainly to the increased demands of the iron and steel industry there.

#### Consumption.

During 1928-32, consumption of coal in Japan averaged about 32 million tons annually, of which about 10 percent was imported coal. The war increased Japan's coal consumption by about 15 million tons. A large part of this increased consumption reflects the activities of heavy industries; consumption of imported coal is mainly dependent upon the operations of heavy industry, especially the iron and steel industry.

The per capita level of civilian consumption of coal in Japan is only about one-fifth that in the United States. This difference is due largely to the difference in the mode of living in Japan, in which almost no coal is used for domestic heating purposes. For this reason, Japan's per capita coal consumption cannot properly be compared with that of other countries. (See also the section on description and uses.)

#### Post-war problems.

Probably the most immediate post-war problem in the coal industry will be that of unemployment, as this industry alone has directly employed during the war very large numbers of workers not only in the mines, but in distribution. It is possible that several hundred thousand persons might be thrown out of work by any extensive stoppage of coal production.

Consequent upon the dismemberment of the Empire, Japan will lose control of more than half the coal reserves, now in its possession, from which Japan has obtained special metallurgical and high-grade fuel coal not existing in Japan and essential to the efficient operation of the metal, chemical, and other heavy industries. If it is the intention of the occupying authorities to allow the continued operation of any medium sized or large scale industries in the country after the war in a pattern similar to that existing from 1930 to 1935, it will be necessary for Japan to import some coal. Probably under these conditions 2.5 million to 3 million tons of high-grade coal will be required to be imported from abroad, whether the source be Manchuria, Korea, or other countries. If for a period of time the industries of Japan were to be used on a large scale for reparations to Korea, China, the Soviet Union, or other nations, special coals would also have to be provided or allowed to be imported from abroad. In this case the quantity required might have to be larger than what was received in pre-war years.

Controls over the production or importation of coal would be difficult to administer. This is true mainly because of the variety of coal types required in the economy of a large country and the numerous different uses to which it is put. Most likely a program of control of Japan's industry



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would best be concentrated on the industries consuming coal rather than on the coal industry, as such controls would rather automatically limit the consumption of coal.

If Japan consumes considerably smaller quantities of coal, or imports a greater percentage of it than formerly from areas other than Manchuria and Korea, a problem of immediate readjustment to smaller markets would very likely occur in the Korean and Manchurian coal industries. Unless, under such circumstances, these two areas could find alternate markets for their surplus coal supplies, or could absorb greater quantities than formerly in domestic uses, a considerable reduction in the plant and manpower needed to produce coal might occur in these areas.

The production of coal in quantities as large as 35 million or 40 million tons in Japan proper, however, makes for very high costs of production, as is evidenced by the extensive protection and positive assistance given the domestic coal industry in recent years. It is likely, therefore, that the removal of such assistance to the industry would greatly reduce the total coal output of Japan in relation to its consumption, thus calling for a larger quantity of imports. Under these conditions the Korean and especially the Manchurian coal industries might find a ready market in Japan for surpluses. In this case these two areas might even experience a foreign demand for coal greater than in the pre-war period.